

Development and utilization of novel measuring methods in the field of neuroscience and dentistry

Semester report conference

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Anatomical background of the dental research based on the dentin recording

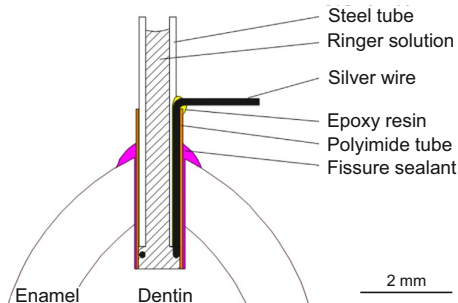
- dentin tubules filled with ionic fluid
- slight overpressure in the pulp
- ion current - dentin recording
- dentin is an electric conductor



Introduction - research field

Former experimental utilization of dentin recording

- nerve control of tooth bleeding (Leif Olgart)
- correlation between the nerve activity and the dental pain (Matti Närhi)
- stimulus effect on dental pain (Bruce Matthews)



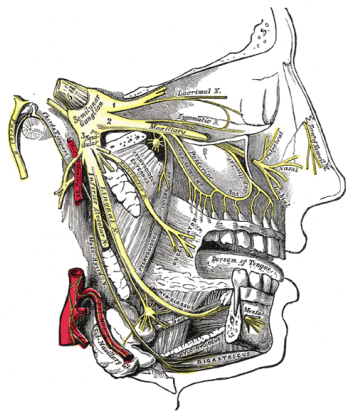
Dentin recording with hydrostatic pressure stimulus

(Vongsavan et al. 2016)

Introduction - research field

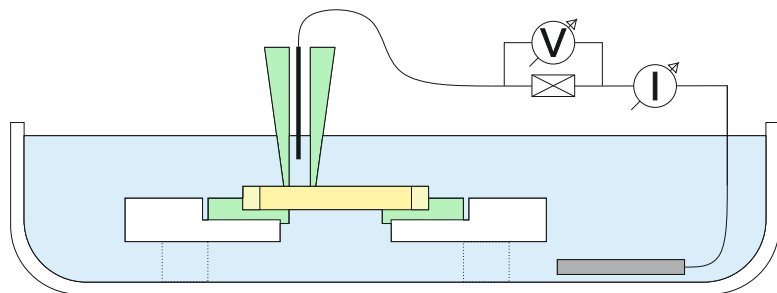
Utilization of dentin recording in my research

- Series of *in vitro* experiments
 - determination of thickness dependent electrical impedance of human dentin
 - dental nerve recording through the dentin
- Device development for *in vivo* application
 - remaining dentin thickness (RDT) measuring electrode
 - prototype hand tool
 - aim for clinical application



[Henry Gray: Anatomy of the Human Body, 1918]

Impedance measurement arrangement



0.154 mol/L Sodium Chloride solution

Ag/AgCl reference electrode

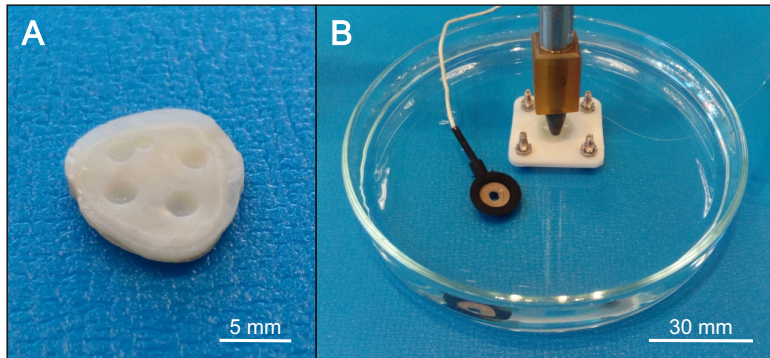
Silicone rubber

Dentin

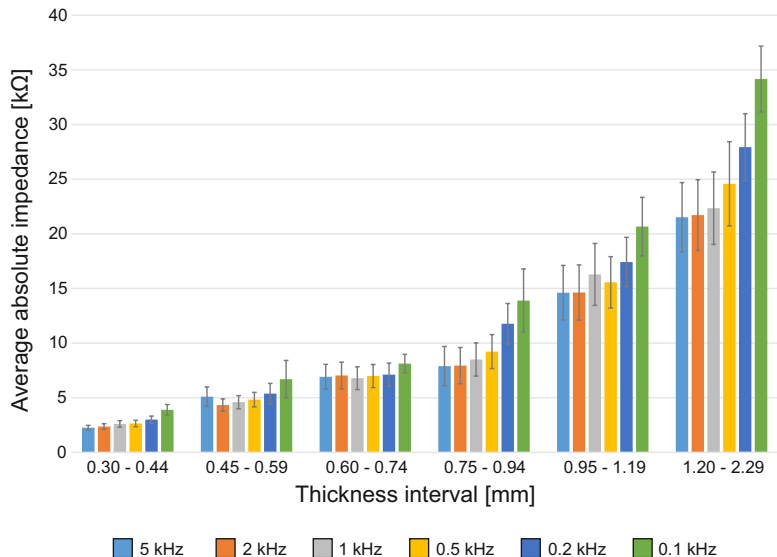
Enamel

Working electrode

Impedance measurement arrangement



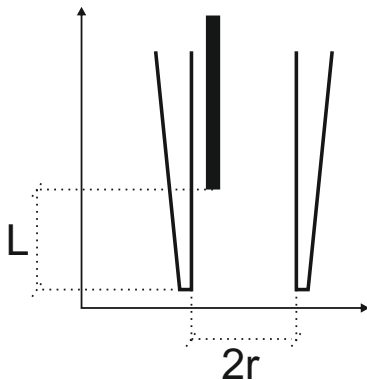
Thickness dependent impedance spectrum



In vivo utilization of the results

- prototype hand tool development based on the results
 - removable biocompatible microelectrode tip
 - design for the clinical application
 - signal processing and displaying IC

- challenge with the downsizing
 - electrical properties
 - mechanical stability
 - fabrication

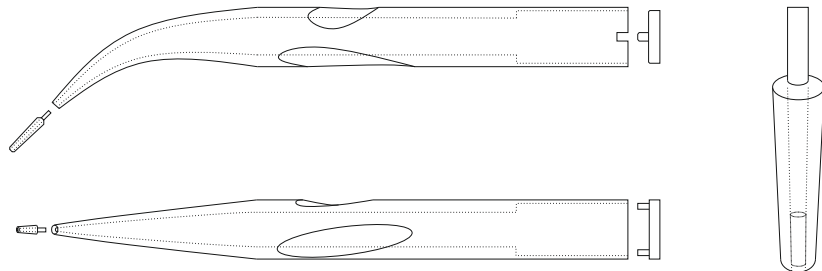


$$R = \frac{\rho L}{\pi r^2}$$

Development of the *in vivo* hand tool

The state of the project

- the result of the *in vitro* experiments is published
- utility model protection is handled in to the Hungarian Intellectual Property Office
- the development of the *in vivo* prototype device is in progress



Results of the semester

Accepted publications in this semester

- Thickness dependent electrical impedance spectrum of human dentin

INTERNATIONAL JOURNAL OF CLINICAL DENTISTRY 13(1) (2020)

Gábor Orbán, Csaba Dobó-Nagy, István Ulbert, Gergely Márton

- Method for spike detection from microelectrode array recordings contaminated by artifacts of simultaneous two-photon imaging

PLOS ONE 14 : 8 p. e0221510 (2019)

Gábor Orbán, Domokos Meszéna, Kinga Réka Tasnády, István Ulbert, Gergely Márton

Summarized results

- Number of publications: 7
- Number of patents: 2
- Credits for publications: 107
- Total credits: 262

Thank you for your attention!

